WHAT IS CLAIMED IS:

1. A method of monitoring status of a system component in a processing system, the method comprising:

exposing a system component to a reactant gas during a process, wherein the reactant gas is capable of etching the system component material to form an erosion product;

monitoring the processing system for release of the erosion product during the process to determine status of the system component; and

based upon the status from the monitoring, performing one of the following: (a) continuing the exposing and monitoring; and (b) stopping the process.

2. The method according to claim 1, wherein the exposing comprises the system component being at least one of a process tube, a shield, a ring, a baffle, a wall, a protective coating, an injector, a substrate holder, a liner, a pedestal, a cap cover, an electrode, and a heater.

3. The method according to claim 1, wherein the exposing comprises the system component containing at least one of an oxide, a nitride, and a carbide.

4. The method according to claim 1, wherein the exposing comprises the system component containing at least one of quartz, Al_2O_3, SiN, and SiC.

5. The method according to claim 1, wherein the exposing comprises the system component having a material deposit thereon, and wherein the process is a cleaning process for removing the material deposit from the system component.

6. The method according to claim 1, wherein the exposing comprises the system component having a material deposit thereon containing at least one of Si, SiGe, SiN, SiO_2, doped Si, HfO_2, $HfSiO_x$, ZrO_2, and $ZrSiO_x$, and wherein the process is a cleaning process for removing the material deposit from the system component.

7. The method according to claim 1, wherein the process comprises at least one of a chamber cleaning process, a chamber conditioning process, a substrate etching process, and a substrate film formation process.

8. The method according to claim 1, wherein the exposing comprises the reactant gas containing a halogen-containing gas for cleaning the system component during a chamber cleaning process.

9. The method according to claim 1, wherein the exposing comprises the reactant gas containing at least one of ClF_3, F_2, NF_3, and HF for cleaning the system component during a chamber cleaning process.

10. The method according to claim 1, wherein the exposing comprises the reactant gas containing at least one of a silicon-containing gas and a nitrogen-containing gas for conditioning the system component during a chamber conditioning process.

11. The method according to claim 1, wherein the exposing comprises the reactant gas containing at least one of dichlorosilane and NH_3 for conditioning the system component during a chamber conditioning process.

12. The method according to claim 1, wherein the exposing comprises the reactant gas containing a halogen-containing gas for etching a substrate during a substrate etching process.

13. The method according to claim 1, wherein the exposing comprises the reactant gas containing HF for etching a substrate during a substrate etching process.

14. The method according to claim 1, wherein the exposing comprises the reactant gas containing at least one of a silicon-containing gas and an nitrogen-containing gas for depositing a film during a substrate film formation process.

15. The method according to claim 1, wherein the exposing comprises the reactant gas containing at least one of NO and tetraethyl orthosilicate for depositing a film during a substrate film formation process.

16. The method according to claim 1, further comprising operating the processing system at a temperature between about 100°C and about 1000°C during the exposing.

17. The method according to claim 1, further comprising operating the processing system at a chamber pressure between about 10mTorr and about 760Torr during the exposing.

18. The method according to claim 1, wherein the system component includes quartz, and further comprising operating the processing system at a chamber pressure of about 200mTorr to about 760 Torr and a temperature of about 200°C to about 800°C during the exposing.

19. The method according to claim 1, wherein the exposing comprises the system component containing quartz with a SiN protective coating and a metal oxide material deposit thereon, and wherein the process is a cleaning process for removing the material deposit from the protective coating.

20. The method according to claim 1, wherein the monitoring comprises using an optical monitoring system to detect light absorption of the erosion product.

21. The method according to claim 20, wherein the monitoring further comprises determining if the intensity level of the light absorption has reached a threshold value.

22. The method according to claim 21, wherein performing (b) stopping the process occurs after determining that the threshold value has been reached.

23. The method according to claim 1, wherein the monitoring comprises using a mass sensor to detect a mass signal from the erosion product.

24. The method according to claim 23, wherein the monitoring further comprises determining if an intensity level of the mass signal has reached a threshold value.

25. The method according to claim 24, wherein performing (b) stopping the process occurs after determining that the threshold value has been reached.

26. The method according to claim 1, wherein the monitoring comprises monitoring release of at least one of a silicon-containing erosion product and a nitrogen-containing erosion product.

27. The method according to claim 1, wherein the monitoring comprises monitoring release of a silicon halide erosion product.

28. The method according to claim 27, wherein the monitoring comprises monitoring release of at least one of SiF_4, $SiCl_4$, and $SiBr_4$.

29. The method according to claim 1, wherein the monitoring comprises monitoring release of a silicon oxyhalide erosion product.

30. The method according to claim 1, wherein the system component comprises a silicon-containing material and the reactant gas comprises a halide-containing gas whereby the exposing forms a silicon halide erosion product, and wherein the monitoring comprises monitoring release of the silicon halide erosion product.

31. A method of monitoring status of a system component in a processing system, the method comprising:

forming a protective coating on a system component;

exposing the protective coating to a reactant gas during a process, wherein the reactant gas is capable of etching the protective coating to form an erosion product;

monitoring the processing system for release of the erosion product during the process to determine status of the system component; and

based upon the status from the monitoring, performing one of the following: (a) continuing the exposing and monitoring; and (b) stopping the process.

32. The method according to claim 31, wherein the forming a protective coating comprises forming at least one of SiN, SiC, SiO_2, Y_2O_3, Sc_2O_3, Sc_2F_3, YF_3, La_2O_3, CeO_2, Eu_2O_3, DyO_3, SiO_2, MgO, Al_2O_3, ZnO, SnO_2, and In_2O_3.

33. A processing system, comprising:

a process chamber;

a system component within the process chamber;

a gas injection system configured for introducing a reactant gas in the process chamber, wherein the reactant gas is capable of etching the system component material to form an erosion product during a process;

a chamber protection system for monitoring the processing system inside the process chamber for release of the erosion product to determine status of the system component and to transmit the status; and

a controller configured to receive the status from the chamber protection system and to control the processing system in response to the status.

34. The processing system according to claim 33, wherein the system comprises at least one of a thermal processing system, a plasma processing system, a chemical vapor deposition system, and an atomic layer deposition system.

35. The processing system according to claim 33, wherein the processing system comprises at least one of a batch type processing system and a single wafer processing system.

36. The processing system according to claim 33, wherein the system component comprises at least one of a process tube, a shield, a ring, a baffle, a wall, a protective coating, an injector, a substrate holder, a liner, a pedestal, a cap cover, an electrode, and a heater.

37 . The processing system according to claim 33, wherein the system component comprises at least one of an oxide, a nitride, and a carbide.

38. The processing system according to claim 33, wherein the system component comprises at least one of quartz, Al_2O, SiN, and SiC.

39. The processing system according to claim 33, wherein the system component comprises a material deposit thereon.

40. The system processing according to claim 33, wherein the system component further comprises a material deposit containing at least one of Si, SiGe, SiN, SiO_2, doped Si, HfO_2, $HfSiO_x$, ZrO_2, and $ZrSiO_x$.

41. The processing system according to claim 33, wherein the chamber protection system comprises an optical monitoring system to detect light absorption of the erosion product.

42. The processing system according to claim 33, wherein the chamber protection system comprises a mass sensor to detect a mass signal from the erosion product.

43. A processing system, comprising:

a process chamber;

a system component within the process chamber;

a gas injection system configured for introducing a reactant gas in the process chamber, wherein the reactant gas is capable of etching the system component material to form an erosion product during a process;

an optical monitoring system for monitoring light absorption from the erosion product during the process to monitor status of the system component, wherein the optical monitoring system is further configured to determine if an intensity level of the light absorption has reached a threshold value, and based on the determination, either continue with the process or stop the process; and

a controller configured to control the processing system in response to the determination.

44. A processing system, comprising:

a process chamber;

a system component within the process chamber;

a gas injection system configured for introducing a reactant gas in the process chamber, wherein the reactant gas is capable of etching the system component material to form an erosion product during a process;

a mass sensor for monitoring a mass signal from the etch product during the process to monitor status of the system component, wherein the mass sensor is further configured to determine if an intensity level of the mass signal has reached a threshold value, and based on the determination, either continue with the process or stop the process; and

a controller configured to control the processing system in response to the determination.